CO_2 Sources for the Southeast Regional Carbon Sequestration Partnership (SECARB)

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This report summarizes the CO_2 source database that has been created for the SERCSP GIS Project. The database contains the location and capacities of the major stationary sources of CO_2 in the study area, which includes the SERCSP member states plus Virginia and eastern Texas (defined by RRC districts 1-6). It also includes annual CO_2 emissions, based on relevant emission factors for each source category. CO_2 emissions from power plants was given directly from the USEPA eGRID database.

The database contains the following eight major stationary source categories:

- Power plants
- Gas processing facilities
- Refineries
- Ammonia plants
- Ethylene plants
- Ethylene oxide plants
- Iron & steel plants
- Cement plants

The database developed by ECOFYS for the IEA GHG program had been used as a preliminary dataset. The work outlined in this report updated and replaced sections of this preliminary database with data sources that were more current and of higher detail and accuracy than the data contained in the ECOFYS database. Where possible, the datasets were updated to include more recent capacity information, changes in plant capacities, as well as accounting for closed and new facilities.

Data Sources for Facility Capacities

New data sources were used for refineries, cement plants and ammonia plants. Updated data was used for gas processing facilities. No changes were made to the data sources of iron and steel, ethylene and ethylene oxide plants because the ECOFYS database already contained the most recent and accurate datasets available for these sources.

The ECOFYS database was used to determine the location of the vast majority of stationary sources in the study area. The USGS Geographical Names Information System database (GNIS) was used to determine coordinates of facilities that were not located in the ECOFYS database.

A summary of the data for each stationary source category is summarized in Table 1, and in the sections following the table.

Table 1 Data Sources

Category	Data Source	Details
Power plants	US Environmental Protection Agency eGRID Database (2002) http://www.epa.gov/cleanenergy/egrid/index.htm	-Best data source identified -Plants located -CO_2 emissions estimated -Database to be updated when 2004 data released (expected summer 2005)
Refineries	US Department of Energy – Energy Information Administration (2004) http://www.eia.doe.gov/oil_gas/petroleum/data_publications/refinery_capacity_data/refcapacity.html	-Best data source identified -Plants located -Plant capacities estimated
Gas processing facilities	Oil and Gas Journal Worldwide Gas Processing Survey (2003) http://orc.pennnet.com/surveys/aboutsurveys.cfm USGS Organic Geochemistry Database http://energy.cr.usgs.gov/prov/og/ (well CO_2 levels)	-Best data sources identified for gas processing capacity and well CO_2 levels -Processing capacities of plants estimated
Ammonia plants	International Fertilizer Development Center Report "North American Fertilizer Capacity" (October, 2004)	-Best data source identified -Plants located -Plant capacities estimated
Ethylene plants	Oil and Gas Journal Ethylene Report (2001)	-Best data source identified -Plants located -Plant capacities estimated
Ethylene oxide plants	ChemWeek (2001)	-Best data source identified -Plants located -Plant capacities estimated
Iron and steel plants	SteelEye Survey (2001)	-Best data source identified -Plants located -Plant capacities estimated
Cement plants	Portland Cement Association, "Portland Cement Association 2002. U.S. and Canadian Portland Cement Industry: Plant Information Summary"	-Best data source identified -Plants located -Plant capacities estimated

CO_2 Emission Factors

The data sources in Table 1, except for the eGRID database provide production capacity numbers and do not provide information on CO_2 emission rates. In order to convert these capacity numbers to CO_2 emission rates, emission factors for each of the source categories were identified. These are outlined in Table 2.

Table 2 CO_2 Emission Factors

Category	Emission Factor	Units	Source
Power	n/a	n/a	CO_2 emissions explicitly given in eGRID database
Ammonia	1.13	kg CO2/kg Ammonia	IFDC
Ethylene	2.43	kg CO2/kg Ethylene	ECOFYS
Ethylene Oxide	0.51	kg CO2/kg Ethylene Oxide	ECOFYS
Cement	0.75	kg CO2/kg Clinker	Hanle (USEPA), CO2 Emissions Profile of the US Cement Industry", 2004
Gas Processing	608	tCO2/mmcfd/yr	ECOFYS, based on 4% average inlet gas CO_2 concentration
Iron and Steel	0.1468	kg CO2/kg Steel	USEPA "Direct Emissions from Iron and Steel Production", 2002
Refineries	9.9	tCO2/BPD/yr	ExxonMobil "Report on Energy Trends, Greenhouse Gas Emissions and Alternative Energy" Report, 2004 - company-wide average refinery emission rate

It is important to note that the CO_2 emissions estimated from applying these emission factors are very approximate, and should be used to compare the relative scale of emissions, and not as an accurate estimate of actual emissions.

Summary of Source Categories

Power Plants

The database uses 2002 US EPA eGRID data for refinery capacities, locations, and CO_2 emission rates. The CO_2 emissions were directly reported, and no emission factors were used to calculate total emissions.

The US EPA updates the eGRID database every 2 years; the last update (with 2000 data) was released May 2003. This data source is the best available for this category, and the database will be updated to 2004 data when available (expected in late summer 2005). Table 3 summarizes the power plants in the study area.

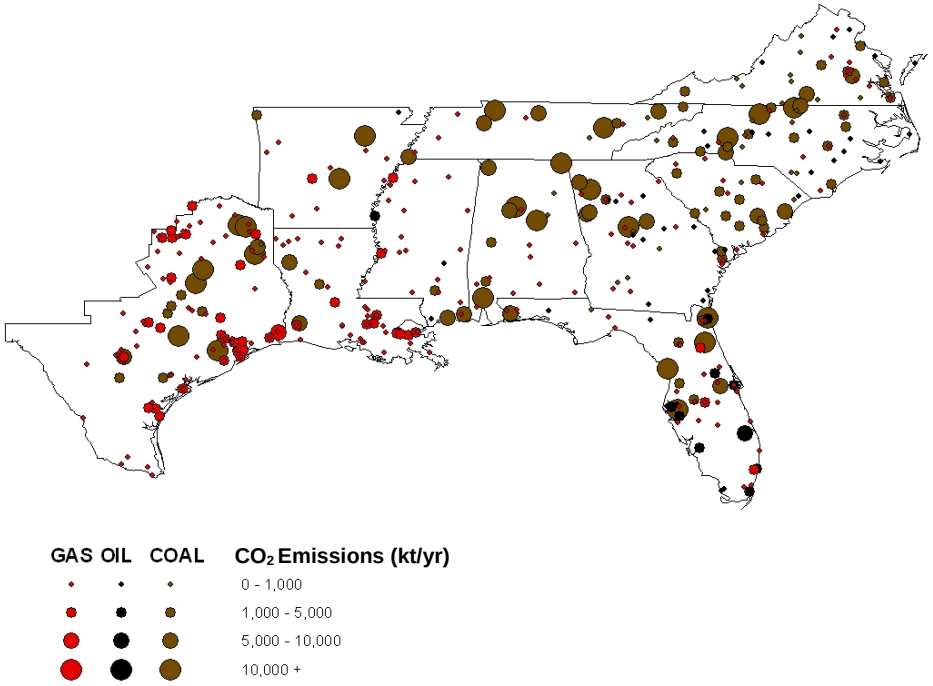
Table 3 Power Generation Capacity and CO_2 Emissions by Fuel, State in SERCSP Study Area (year 2000)

	Gas			Oil			Coal		
State	**Number**	**Capacity (MW)**	**CO_2 Emissions (Mt)**	**Number**	**Capacity (MW)**	**CO_2 Emissions (Mt)**	**Number**	**Capacity (MW)**	**CO_2 Emissions (Mt)**
AL	15	1,030	1.9	0	0	0.0	10	14,904	88
AR	12	2,637	3.4	1	8	0.0	3	3,911	29
FL	42	10,045	12.4	23	15,218	31.4	13	12,732	74
GA	19	4,501	2.0	25	1,205	1.1	16	15,804	84
LA	54	14,795	31.1	0	0	0.0	4	3,360	18
MS	22	4,621	6.6	3	807	2.5	4	2,498	16
NC	7	3,747	1.2	12	118	0.0	29	14,548	78
SC	8	2,029	0.5	3	246	0.0	14	7,637	41
TN	5	1,132	0.3	0	0	0.0	13	12,990	65
TX*	126	47,793	89.6	1	11	0.0	17	19,197	143
VA	12	3,781	1.6	13	435	0.1	21	6,855	37
Total	**322**	**96,110**	**151**	**81**	**18,048**	**35**	**144**	**114,435**	**671**

*For eastern portion of Texas in SERCSP

Figure 1 shows the geographical distribution and relative CO_2 emissions for fossil-fuelled power plants in the SERCSP region.

Figure 2 Fossil-Fuelled Power Plants in the SERCSP Region



Refineries

The online database of the Energy Information Agency (EIA) of the US Department of Energy was used to revise capacity estimates of refineries in the study area. The ECOFYS database was used for plant locations, with the USGS Geographical Names Information System (GNIS) used to verify and update the location of new facilities.

Table 3 Refinery Capacity and CO_2 Emissions for Refineries

State	Number	Capacity (1000 barrels / stream day)	CO_2 Emissions (kt/year)
AL	3	130	1,289
AR	2	97	955
FL	0	0	0
GA	1	34	332
LA	16	2,452	24,275
MS	1	227	2,242
NC	0	0	0.0
SC	0	0	0.0
TN	1	120	1,188
TX	16	3,002	29,719
VA	1	250	2,475
Total	**41**	**6,311**	**62,475**

*For eastern portion of Texas in SERCSP

Gas Processing Facilities

The database for gas processing facilities was updated with data from the 2003 Oil and Gas Journal Gas Processing survey. This database was cross-referenced with the ECOFYS database to determine the locations of facilities. In addition, the USGS GNIS databasewas used to locate facilities not included in the ECOFYS database.

The CO_2 emission rate from gas processing facilities is highly dependent on the percentage of CO_2 in the gas being processed by each facility. In order to estimate these emissions, the USGS organic geochemistry database has been obtained. This database contains the CO_2 concentrations of gas wells in the study area. Current work is focusing on linking the wells in this database with each gas processing facilities. This will provide a better basis to estimate the CO_2 emissions of each gas processing facility.

Table 4 Gas Processing Capacity and CO_2 Emissions Estimates

State	Number	Capacity (MMCFD/year)	CO_2 Emissions (kt/year)
AL	9	766	466
AR	2	872	531
FL	1	90	55
GA	0	0	0
LA	47	10,015	6,092
MS	9	1,876	1,141
NC	0	0	0
SC	0	0	0
TN	0	0	0
TX*	96	12,455	7,577
VA	0	0	0
Total	164	26,074	15,862

*For eastern portion of Texas in SERCSP

Ammonia Plants

The ammonia plant database was updated with the latest available numbers from the International Fertilizer Development Commission (IFDC). The most recent numbers were released in October 2004. This database was cross-referenced with the ECOFYS database to determine the locations of facilities. In addition, the USGS GNIS database was used to locate facilities not included in the ECOFYS database.

Table 5 Ammonia Plant Capacity and CO_2 Emissions Estimates by State in SERCP Region

State	Number	Capacity (kt/year)	CO_2 Emissions Estimate (kt/year)
AL	1	193	218.1
AR	1	467	527.7
FL	1	86	97.2
GA	1	758	856.5
LA	8	5605	6333.7
MS	0	0	0.0
NC	0	0	0.0
SC	0	0	0.0
TN	1	409	462.2
TX*	1	255	288.2
VA	1	584	659.9
Total	15	8357	9443

*For eastern portion of Texas in SERCSP

Cement Plants

The cement plant database was revised with new data from the Portland Cement Industry Association. The most recent database (December 2001) was used. This database was cross-referenced with the ECOFYS database to determine the locations of facilities. In addition, the USGS GNIS database was used to locate facilities not included in the ECOFYS database.

Table 6 Cement Plant Capacity and CO_2 Emissions Estimates by State in SERCSP Region

State	number	Capacity (kt/year)	CO_2 Emissions (kt/year)
AL	5	5,308	3,981
AR	1	803	602
FL	4	3,158	2,369
GA	2	1,355	1,016
LA	0	0	0
MS	1	419	314
NC	0	0	0
SC	3	2,725	2,044
TN	2	1,436	1,077
TX*	9	9,917	7,438
VA	1	1,120	840
Total	28	26,241	19,681

*For eastern portion of Texas in SERCSP

Iron and Steel, Ethylene and Ethylene Oxide Plants

The ECOFYS database contained the most detailed, recently available datasets for these sources. No changes were made to these databases.

Table 7 Iron and Steel Plants Capacity and Emissions Estimate by State in SERCSP Region

State	Number	Capacity (kt/year)	CO_2 Emissions (kt/year)
AL	5	3,739	549
AR	4	2,115	310
FL	1	356	52
GA	1	712	105
LA	1	712	105
MS	2	401	59
NC	3	890	131
SC	4	2,992	439
TN	3	1,602	235
TX*	6	2,271	333
VA	2	1,647	242
Total	32	17,437	2,560

*For eastern portion of Texas in SERCSP

Table 8 Ethylene Plants Capacity and Emissions Estimate by State in SERCSP Region

State	number	Capacity (kt/year)	CO_2 Emissions (kt/year)
AL	0	0	0
AR	0	0	0
FL	0	0	0
GA	0	0	0
LA	5	3,547	8,619
MS	0	0	0
NC	0	0	0
SC	0	0	0
TN	0	0	0
TX*	19	16,870	40,994
VA	0	0	0
Total	24	20,417	49,613

*For eastern portion of Texas in SERCSP

Table 9 Ethylene Oxide Plants Capacity and Emissions Estimate by State in SERCSP Region

State	Number	Capacity (kt/year)	CO_2 Emissions (kt/year)
AL	0	0	0
AR	0	0	0
FL	0	0	0
GA	0	0	0
LA	4	1,730	882
MS	0	0	0
NC	0	0	0
SC	0	0	0
TN	0	0	0
TX*	7	2,255	1,150
VA	0	0	0
Total	11	3,985	2,032

*For eastern portion of Texas in SERCSP

Figure 3 Non-Power Stationary CO_2 Sources in the SERCSP Region